Merced Integrated Regional Water Management Implementation Grant Proposal

Attachment 7: Technical Justification of Projects

Attachment 7 consists of the following items:

- ✓ **Proposal Description and Summary of Benefits**
- ✓ **Technical Justification for Physical Benefits Claimed**

Proposal Description and Summary of Benefits

The *Merced Integrated Regional Water Management (IRWM) Implementation Grant Proposal* includes a suite of projects selected based on their ability to address the highest priority objectives of the Merced Region, distribute benefits throughout the region and address critical disadvantaged community (DAC) needs. The following four projects included in this proposal provide a suite of benefits that will benefit not only the Merced Region, but also provide benefits statewide due to the region's vital connection to the Delta and its contribution to the state's agricultural economy.

- Black Rascal Flood Control Project
- Planada Community Service District Water Conservation Project
- El Nido Area Recharge Project
- Merced River Education and Enhancement Program

Table 7-1 summarizes the physical benefits that would be achieved through implementation of this Proposal.

Table 7-1: Summary of Proposal Physical Benefits

Project	Benefit Summary
Water Supply	
Planada Community Service District Water Conservation Project	100 AFY decreased water use through water demand reduction and decreased water distribution conveyance losses
El Nido Area Recharge Project	4,489 AFY of increased water deliveries 3,501 AFY of reduced groundwater pumping
Water Quality	
El Nido Area Recharge Project	Reduction in groundwater nitrate concentration, which averages 15.7 mg/L, through recharge of surface water with nitrates <2 mg/L
Flood Damage Reduction	

Project	Benefit Summary
Black Rascal Flood Control Project	Avoided flood damage to 300 residences and agricultural lands during a 200-year event
El Nido Area Recharge Project	Reduction of flood flows by 100 cfs
Recreational Resources	
Merced River Education and Enhancement Program	137 new recreational visitor days
Environmental Resources	
Merced River Education and Enhancement Program	Removal of invasive species (e.g. water hyacinth, arundo and star thistle) at 2 locations along the Merced River Habitat restoration at 2 demonstration sites covering a total of 5 acres Retirement of 2 acres of agriculture to enhance wildlife habitat
Energy	
El Nido Area Recharge Project	15,773 MT of carbon dioxide (CO_2) emissions avoided
Other Physical Benefits	
Planada Community Service District Water Conservation Project	Increase in minimum distribution system pressure to 20 psi.
Merced River Education and Enhancement Program	1 life saved every 10 years due to river recreation safety improvements Reduction of 2 emergency responses per year to rescue people in the river

Technical Justification for Physical Benefits Claimed

This section summarizes the technical work that has been completed to quantify and substantiate the physical benefits summarized in Table 7-1.

Black Rascal Flood Control Project

The Black Rascal Flood Control Project will identify a preferred approach to providing flood protection to the communities of of Merced and Franklin/Beachwood during a 200-year storm event on the Black Rascal Creek Watershed. In addition to flood control benefits, implementation of the preferred project is anticipated to include habitat enhancements through creation of a deadpool in the reservoir and water supply reliability improvements by allowing the Merced Irrigation District (MID) to regulate flows. Since the acreage of habitat enhancement and the quantity of increased water storage still have to be defined through the development of the preferred project, the physical benefits claimed in this proposal are limited to the benefits related to reduced flooding.

Existing Data and Studies

The Black Rascal Flood Control Project is supported by a series of studies documenting the potential project benefits, including:

- Feasibility Study and Addendum 1, Black Rascal Creek Flood Control (June 2008, amended February 2009) – included as Appendix 7-1
- Merced County Streams California, General Design Memorandum Phase 1 Plan Formulation, (March 1980) – included as Appendix 7-2
- MIRWMP Flood Management Summary (March 2013) – included as Appendix 7-3
- Hemming & Morse Inc, Expert Report of Daniel W. Ray, Abarca, el al. v. Merced Irrigation District, et. al. United States District Court Case No. 1:07-CV-0388 OWW DLB. (2006)– included as Appendix 7-4
- Merced March & April 2006 California County Agricultural Commissioner Disaster Report (2006) – included as Appendix 7-5

Summary of Benefits

The projected project benefits include:

- **Flood Damage Reduction:** The project will protect the communities of Merced and Franklin/Beachwood from a 200-year flood event, reducing flood damage incurred by residences and agricultural lands.

These benefits are summarized in the following table.

Table 7-2: Black Rascal Flood Control Project Benefits Summary

Category	Benefit Summary
Water Supply	No quantified physical benefits
Water Quality	No quantified physical benefits
Flood Damage Reduction	Avoided flood damage to 300 residences and agricultural lands during a 200-year event
Environmental Resources	No quantified physical benefits
Recreation/Public Access	No quantified physical benefits
Energy	No quantified physical benefits
Other Physical Benefits	No quantified physical benefits

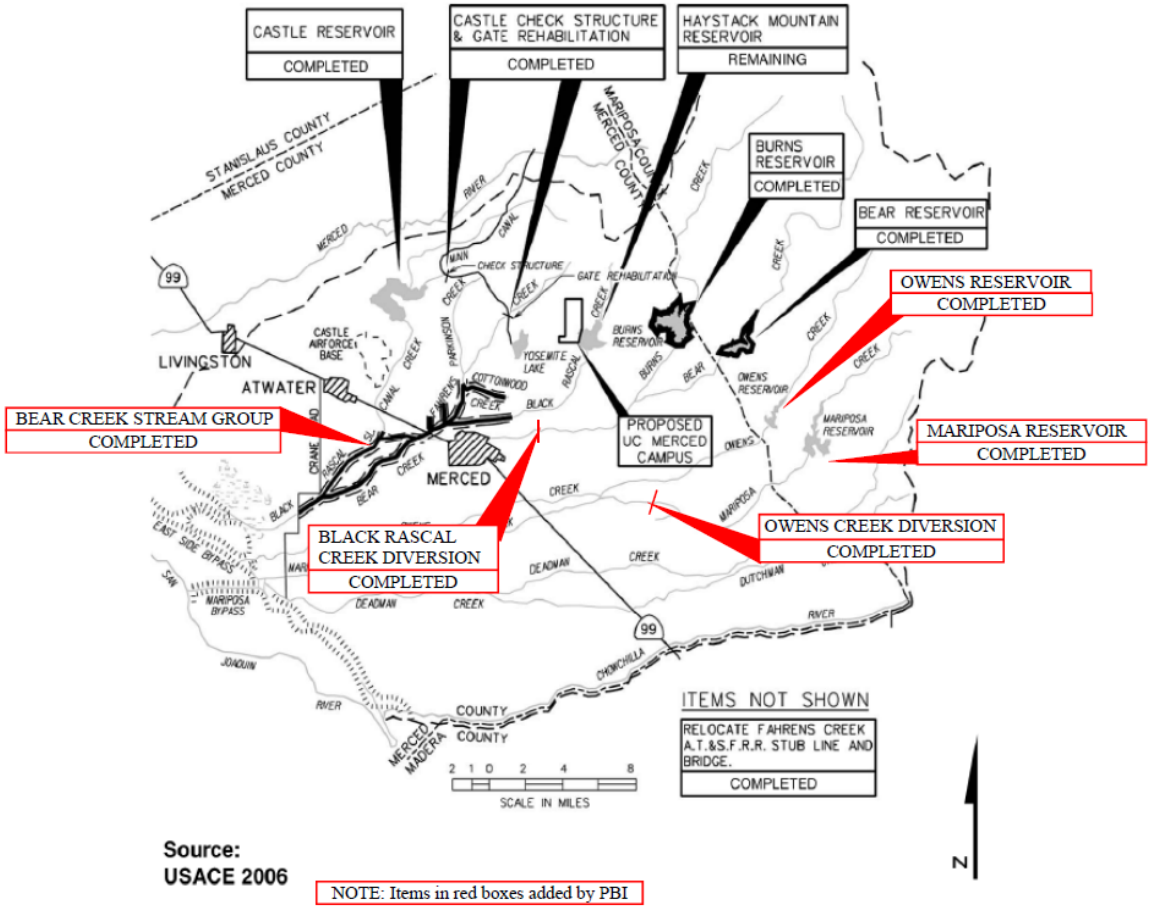
Background / Recent and Historical Conditions

As discussed in Section 1 of the *Feasibility Study and Addendum 1, Black Rascal Creek Flood Control* (see Appendix 7-1, p.1-1), the area along Black Rascal Creek near the Black Rascal Creek diversion channel has flooded several times in recent years. The City and County of Merced anticipate new development and housing in the project area, which was severely inundated in 100-year storm events experienced in 1998 and 2006.

The U.S. Army Corps of Engineers (USACE) identified the need for a flood control structure on Black Rascal Creek in 1970, and recommend that a dam be constructed on the creek. This project, which was known as the Haystack Dam, is documented in the UASCE 1980 *Merced County Streams California, General Design Memorandum Phase 1 Plan Formulation* (see Appendix 7-2, pp. 1, 5, 72, 74, 76). Later, due to environmental concerns, the USACE placed the Haystack Dam under general re-evaluation, where federal plans for flood control on the Black Rascal watershed remain today.

As part of the IRWM planning process, the Merced Region completed a Flood Management Summary. Figure 3 of the Flood Management Summary (see Appendix 7-3 p. 4), which is reproduced below, summarizes the status of the USACE Merced County Streams Group Projects. As indicated in the figure, the Haystack Dam is the only component of the USACE Merced County Streams Group that is not completed at this time.

FIGURE 3 – Merced County Streams Group Project Status



Following decades of federal inactivity with respect to Haystack Dam, the County of Merced, in conjunction with the City of Merced and MID, opted to evaluate the effectiveness of alternative detention basin flood control projects to reduce 100-year flood flows from Black Rascal Creek. To this end, the three partners jointly completed the *Feasibility Study, Black Rascal Creek Flood Control* in June 2008. This feasibility was amended in February 2009 to respond to flood legislation passed in 2007, which established a 200-year level of flood protection as the standard for urban development and also to position the region for funding assistance from the state.

The majority of the area served by the project is designated a DAC based on American Community Survey (ACS) data for the years of 2006 to 2010. The service area therefore does not have the revenue base to independently support the needed flood control improvements.

Without Project Conditions

Without the project, the status quo will continue, meaning properties within the floodplain would be at risk of damage from flooding. These areas include the central part of City of Merced along Bear Creek and the unincorporated area of Franklin/Beachwood in Merced County (downstream of Bear Creek and Black Rascal Creek confluence). Additionally, Merced County, the City of Merced, and MID would continue to be at risk of lawsuits, potentially incurring significant legal costs.

Damage from the 2006 Flood affecting DACs in Merced

Relationship to Other Proposed Projects

As discussed in Attachment 3, the projects included in this proposal are all intrinsically linked through the objectives of the Merced Integrated Regional Water Management Program. However, no other projects in this proposal must be implemented to achieve the benefits claimed in this attachment.

The Black Rascal Flood Control Project is critical to the Merced Region's commitment to addressing critical water-related needs of DACs, which is one of the high objectives of the Merced Integrated Regional Water Management Plan (MIRWMP) and also an objective of this proposal.

Description of Benefits and Methods to Estimate Benefits

The following sections summarize project benefits and methods used to estimate benefits in the following areas:

- Water Supply
- Water Quality
- Flood Damage Reduction
- Environmental Resources
- Recreation/Public Access
- Energy
- Other Physical Benefits

Water Supply Benefits

No quantifiable water supply benefits are claimed as a result of project implementation.

Water Quality Benefits

No quantifiable water quality benefits are claimed as a result of project implementation.

Flood Damage Reduction Benefits

Property damage from flooding in 2006 are summarized in the *Expert Report of Daniel W. Ray*. The report documents damage to 300 residences with total flood damage costs (personal property losses plus structural repair costs) of $18,250,538 (see Appendix 7-4 p.2). Additionally, David Robinson, the Agricultural Commissioner for the County of Merced estimated that agricultural damages in 2006 totaled $3 million as reported in the *Merced March & April 2006 California County Agricultural Commissioner Disaster Report* (see Appendix 7-5) Given that the 2006 storm was considered a 100-year event and the Black Rascal Flood Control Project will be designed to provide 200-year flood protection, at minimum, the implemented project can be expected to avert the damages experienced in 2006, which equate to estimated annual property and agricultural damages of $2,420,137. The method for calculating this expected annual damage is discussed in Attachment 8.

Environmental Benefits

No quantifiable environmental benefits are claimed as a result of project implementation.

Recreation/Public Access Benefits

No quantifiable recreation / public access benefits are being claimed as a result of project implementation.

Energy-Related Benefits

No quantifiable energy-related benefits are being claimed as a result of project implementation.

Other Physical Benefits

No other quantifiable benefits are being claimed as a result of project implementation.

Facilities Required to Achieve Benefits

In order to achieve the benefits summarized above, final design and construction of the preferred alternative to be developed through the Black Rascal Flood Control Project is necessary. This proposed project will complete the environmental documentation and preliminary design for the flood control facility.

Uncertainty of Benefits

The benefits claimed are based on conservative estimates. While the Black Rascal Flood Control Project will be designed to provide flood protection from a 200-year storm, the benefits are estimated based on protection from a 100-year storm.

Project Adverse Effects

Implementation of the project will have temporary, construction-related impacts as well as long-term impacts to sensitive biological resources. The long-term impacts include direct loss of habitat at the site of the detention basin and indirect degradation of seasonal wetland habitats due to periodic, seasonal inundation.

Annual Project Physical Benefits

The following tables summarize the expected annual benefits from this project.

Table 7-3: Black Rascal Flood Control Project Avoided Flood Damage Costs

Project Name: Black Rascal Flood Control Project Type of Benefit Claimed: Avoided Flood Damage Measure of Benefit Claimed (Name of Units): Dollars Additional Information About this Measure:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2013-2022	$0	$0	$0
2023-2122	$0	$2,420,137	$2,420,137
Comments: See Appendix 7-4 and 7-5 for estimated damages from a 100-year event and Attachment 8 for the calculation of the expected annual avoided damage			

Planada Community Services District Water Conservation Project

The Planada Community Services District Water Conservation Project will provide water conservation benefits to one of the most disadvantaged communities in the region. The proposed project would replace a dilapidated and undersized section of pipe in the delivery system, complete water meter installation for approximately a third of the DAC, and replace an existing, out-dated standby generator. By completing water metering for the community, the District will be able to shift from the current flat rate charge to a volumetric charge. This shift, combined with the ability for the District to locate water leaks in real time, is anticipated to save approximately 20% over current water usage.

Existing Data and Studies

The Project is supported by a series of studies documenting the potential project benefits, including:

- Preliminary Engineering Report for the Water System Rehabilitation & Conservation Project (October 2012) – included as Appendix 7-6
- Planada Community Services District Minutes January 4, 2011 – included as Appendix 7-7
- Planada 2011 and 2012 Water Use Data – included as Appendix 7-8

Summary of Benefits

The projected project benefits include:

- **Water Supply:** The project is estimated to reduce water consumption in Planada Community Services District by 20%.
- **Other:** The project will ensure that the minimum pressure requirements of the Title 22 California Waterworks Standards are met throughout the distribution system.

Table 7-4: Planada Community Services District Water Conservation Project Benefits Summary

Category	Benefit Summary
Water Supply	100 AFY decreased water use through water demand reduction and decreased water distribution conveyance losses
Water Quality	No quantified physical benefits
Flood Damage Reduction	No quantified physical benefits
Environmental Resources	No quantified physical benefits
Recreation/Public Access	No quantified physical benefits
Energy	No quantified physical benefits
Other Physical Benefits	Increase in minimum distribution system pressure to 20 psi.

Background / Recent and Historical Conditions

As discussed in the *Preliminary Engineering Report for the Water System Rehabilitation & Conservation Project*, Planada Community Services District has plans to to improve its domestic water system, including rehabilitation of a portion of the distribution system, completion of water metering in the service area and replacement of a generator.

There are various water lines in Planada's distribution system that are too small to meet the minimum pressure requirements of the Title 22 California Waterworks Standards. In addition, the pipe material is thin-walled, does not meet the requirements of the CWS, and according to the maintenance supervisor, is easily broken with a shovel (see Appendix 7-6 p. 6)

Over the years and as the budget permits, the District has been adding water meters to the system. There are currently 593 touch-read meters and 113 manual-read meters installed. This leaves over 400 connections unmetered (see Appendix 7-6 p. 3).

It should also be noted that the back-up generator at the District's Well 5 is very old, emits smoke and does not meet air quality standards. As documented in Planada Community Services District Board of Directors Special Meeting on January 4, 2011, the San Joaquin Unified Air Pollution Board has indicated the generator must be replaced or repaired (see Appendix 7-7).

Planada's Existing Distribution System Infrastructure is Undersized and Does Not Provide Adequate Fire Flows

Without Project Conditions

Without the project, the status quo will continue, meaning reliability of service to customers will continue to suffer with operating pressures below Title 22 standards, which threatens system integrity and public safety through inadequate fire flows.

Additionally the community of Planada would not be fully metered and would be unable to implement volumetric water rates.

Relationship to Other Proposed Projects

As discussed in Attachment 3, the projects included in this proposal are all intrinsically linked through the objectives of the Merced Integrated Regional Water Management Program. However, no other projects in this proposal must be implemented to achieve the benefits claimed in this attachment.

The Planada Community Services District Water Conservation Project is critical to the Merced Region's commitment to addressing critical water-related needs of DACs, which is one of the high objectives of the Merced Integrated Regional Water Management Plan (MIRWMP) and also an objective of this proposal.

Description of Benefits and Methods to Estimate Benefits

The following sections summarize project benefits and methods used to estimate benefits in the following areas:

- Water Supply
- Water Quality
- Flood Damage Reduction
- Environmental Resources
- Recreation/Public Access
- Energy
- Other Physical Benefits

Water Supply Benefits

The Planada Community Services District Water Conservation Project will install 400 meters in the Planada Community Services District service area. This will complete installation of water meters throughout the connections in the Planata Community Services District service area, and allow use of volumetric charges in the Planada Community Services District for the first time instead of current fixed charge per month that does not depend on water usage. When customers are charged according to their water usage, evidence shows that demand will be reduced compared to the level of demand under fixed charges. Percent reductions from volumetric charges with meters compared to unmetered connections range from 15 to 39% (DeOreo, et al. 2011; Koplow and Lownie, 1999), and anecdotal evidence from smaller utilities in Colorado shows that much larger percent reductions in demand are possible. For this analysis, a 20% reduction in demand is assumed, however, this is considered a conservative estimate, and actual demand reduction will likely be higher than this amount, given that Planada Community Services District serves 1,000 connections.

Water use data for Planada show that the average monthly use during the last six months of 2012 was 35,536,567 gal/month (see Appendix 7-8). Given that Planada had 1,029 service accounts in 2012, the average use per account was calculated to be 34,535 gal/month, or 1.27 AFY. For the 400 accounts that would be metered as through this project, the totally yearly consumption would be 509 AFY. Applying the estimated 20% reduction in water consumption as a result of volumetric pricing, the estimated savings is 102 AFY for the 400 meters.

Water Quality Benefits

No quantifiable water quality benefits are claimed as a result of project implementation.

Flood Damage Reduction Benefits

No quantifiable flood damage benefits are claimed as a result of project implementation.

Environmental Benefits

No quantifiable environmental benefits are claimed as a result of project implementation.

Recreation/Public Access Benefits

No quantifiable recreation / public access benefits are being claimed as a result of project implementation.

Energy-Related Benefits

No quantifiable energy-related benefits are being claimed as a result of project implementation.

Other Physical Benefits

The project will provide a measurable increase in average distribution system operating pressure. As documented in the *Preliminary Engineering Report for the Water System Rehabilitation & Conservation Project* (see Appendix 7-6 pp. 9-10), minimum pressure requirements are not met at all times in the current system. Modeling results suggest that after existing undersized mains have been replaced with 8-inch mains, the system will maintain a minimum pressure of 28 psi.

Facilities Required to Achieve Benefits

In order to achieve the benefits summarized above, all project components must be implemented, including:

- Installation of the new water distribution pipeline and appurtenances
- Completion of metering through installation of 400 new meters
- Implementation of volumetric pricing

Uncertainty of Benefits

The 20% reduction in water consumption assumed as part of this project is a conservative estimate. Published percent reductions from volumetric charges with meters compared to unmetered connections range from 15 to 39% (DeOreo, et al. 2011; Koplow and Lownie, 1999), and anecdotal evidence from smaller utilities in Colorado shows that much larger percent reductions in demand are possible.

The expectation that of the rehabilitated system to meet minimum pressure requirements is based on WaterCAD modeling, which has some uncertainty.

Project Adverse Effects

The project will have temporary, construction-related impacts. No long-term adverse effects are expected from this project, and any adverse project effects will be fully mitigated.

Annual Project Physical Benefits

The following tables summarize the expected annual benefits from this project.

Table 7-5: Planada Community Services District Water Conservation Water Savings

Project Name: Planada Community Services District Water Conservation Project Type of Benefit Claimed: Demand (Water Use) Measure of Benefit Claimed (Name of Units): Acre-Feet Additional Information About this Measure:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012-2015	509	509	0
2016-2030	509	407	102
Comments:			

Table 7-6: Planada Community Services District Water Conservation Pressure Increase

Project Name: Planada Community Services District Water Conservation Project Type of Benefit Claimed: Minimum System Pressure Measure of Benefit Claimed (Name of Units): PSI Additional Information About this Measure:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012-2015	<20	<20	0
2016-2030	<20	28	8
Comments:			

El Nido Area Recharge Project

The El Nido Area Recharge Project will improve an existing surface water diversion structure, yielding multiple benefits to a DAC area with severe groundwater overdraft. The project will replace the existing manual diversion structure on Mariposa Creek with a new automated structure and install monitoring equipment within the El Nido area to monitor recharge. Currently, the manual structure does not allow the MID to maximize water capture. Upgrades would allow MID to increase use of an existing surface water right. The captured water will be directed to an existing recharge basin for direct recharge or to agricultural lands in El Nido for in lieu recharge. An additional benefit of this project is reduction of flood flows downstream of the diversion structure.

Existing Data and Studies

The Project is supported by a series of studies documenting the potential project benefits, including:

- Merced Irrigation District Water Right Summary for El Nido Irrigation District – included as Appendix 7-9
- Well Level Compilation – included as Appendix 7-10
- El Nido Deliveries Calculations – included as Appendix 7-11
- El Nido Additional Recharge Calculation – included as Appendix 7-12
- Merced County Division of Environmental Health Private Domestic Well Data – included as Appendix 7-13
- El Nido Area Pump Test Data – included as Appendix 7-14

Summary of Benefits

The projected project benefits include:

- **Water Supply:** The project will allow MID to exercise an existing water right and provide surface water to the El Nido area.
- **Water Quality**: Recharge of surface water will reduce the concentration of some constituents in groundwater
- **Flood Damage Reduction:** Increased diversions from Mariposa Creek for use in the El Nido atra will decrease flood flows further downstream on Mariposa Creek
- **Energy:** Offsetting groundwater pumping through in lieu recharge decreases the energy consumption associated with pumping

These benefits are summarized in the following table.

Table 7-7: El Nido Area Recharge Project Benefits Summary

Category	Benefit Summary
Water Supply	4,489 AFY of increased water deliveries 3,501 AFY of reduced groundwater pumping
Water Quality	Reduction in groundwater nitrate concentration, which averages 15.7 mg/L, through recharge of surface water with nitrates <2 mg/L
Flood Damage Reduction	Reduction of flood flows by 100 cfs
Environmental Resources	No quantified physical benefits
Recreation/Public Access	No quantified physical benefits
Energy	15,773 MT of carbon dioxide (CO2) emissions avoided
Other Physical Benefits	No quantified physical benefits

Background / Recent and Historical Conditions

MID holds two existing licenses from the State Water Resources Control Board (SWRCB) for diversion of flows from Mariposa Creek between the months of November and April for recharge in the El Nido area (see Appendix 7-9). Currently, MID is unable to make use of these rights in advance of the irrigation season because the existing diversion infrastructure, which requires manual, on-site operation, makes it difficult and dangerous to release impounded flows in emergency situations. By replacing the existing structure with an automated structure, MID can safely divert flows to the existing El Nido recharge basin, maximizing use of existing water rights and replenishing groundwater in the DAC of El Nido.

This past year was a dry year, and 2013 is shaping up to be a critically dry year. In these years MID and El Nido users use groundwater to supplement shortages. Groundwater water has dropped over the years (see Appendix 7-10) and the project will reduce the rate of drop. The amount of water proposed for recharge within El Nido equates to approximately 20% of the total water usage for El Nido, as documented in the El Nido Deliveries Calculations (see Appendix 7-11).

Without Project Conditions

Without the project, the status quo will continue, meaning MID will not fully utilize the two surface water rights it manages for the benefit of the El Nido area. Agricultural users will continue pumping groundwater to supplement surface water deliveries from MID, and domestic wells remain dependent on existing levels of groundwater.

Relationship to Other Proposed Projects

As discussed in Attachment 3, the projects included in this proposal are all intrinsically linked through the objectives of the Merced Integrated Regional Water Management Program. However, no other projects in this proposal must be implemented to achieve the benefits claimed in this attachment.

The El Nido Recharge Bain is critical to the Merced Region's commitment to addressing critical water-related needs of DACs, which is one of the high objectives of the Merced Integrated Regional Water Management Plan (MIRWMP) and also an objective of this proposal.

Description of Benefits and Methods to Estimate Benefits

The following sections summarize project benefits and methods used to estimate benefits in the following areas:

- Water Supply
- Water Quality
- Flood Damage Reduction
- Environmental Resources
- Recreation/Public Access
- Energy
- Other Physical Benefits

Water Supply Benefits

The El Nido Additional Recharge Calculation (see Appendix 7-12) consists of a spreadsheet that calculates potential additional water supply that can be captured at Mariposa Dam, which is the diversion point for the licenses summarized in Merced Irrigation District Water Right Summary for El Nido Irrigation District, and delivered to the El Nido area for direct or in-lieu groundwater recharge (see Appendix 7-9). As documented in the El Nido Additional Recharge Calculaton, in calculating the average annual water supply benefit conservative assumptions were made including conveyance losses between the point of diversion and delivery to the El Nido area. On average, MID estimates that 4,489 AFY could be captured as recharge – either direct recharge or in-lieu.

The El Nido Additional Recharge Calcualtion also estimates the volume of water that can will be recharged directly vs in-lieu. Approximately 22% of the water will be applied directly to the existing recharge basin groundwater with the remaining 78% supplied to agricultural customers in an average year for in-lieu recharge. Water captured by the project will therefore provide agricultural users with 3,501 AFY over the expected 25-year lifetime of benefits, all of which would otherwise have been supplied through extracted groundwater.

Water Quality Benefits

The surface water deliveries from Mariposa Creek will have lower concentrations of nitrates than the existing groundwater. Data from the Merced County Division of Environmental Health Private Domestic Well Data indicates that the average groundwater nitrate concentration around El Nido is 15.7 mg/L (see Appendix 7-13). Water quality monitoring upstream of the El Nido diversion point indicate that the

surface water nitrate concentration is generally <2 mg/L. Recharge of the groundwater basin with the surface water will improve drinking water quality for domestic users.

Flood Damage Reduction Benefits

The project will reduce flood flows heading to Highway 59 by 100 cfs. Highway 59 is subject to recurring flooding and closure as a result of flooding from Mariposa Creek. By maximizing MID's diversions from Mariposa to the maximum allowed 100 cfs, this project would reduce peak flows downstream of the diversion by 100 cfs.

Environmental Benefits

No quantifiable environmental benefits are being claimed as a result of project implementation.

Recreation/Public Access Benefits

No quantifiable recreation / public access benefits are being claimed as a result of project implementation.

Energy-Related Benefits

Water delivered by this project will avoid approximately 3,501 AFY of groundwater from being extracted for agricultural use. With approximately 509 kWh of energy required to pump one acre-foot of groundwater (which is based on an average of historic pump test data, see Appendix 7-14), this project will additionally avoid use of approximately 1,782 MWh of electricity per year. Over the 25-year expected lifetime of project benefits, total water storage achieved through this project will prevent approximately 44,556 MWh of electricity from being used to extract groundwater for agricultural use.

To calculate the CO2 emissions rate associated with energy use in California, we relied on 2009 EPA eGRID data. As noted above the California Energy Commission (2011) reports that 70% of electricity used in California is generated in-state, 20% is generated in the WECC Southwest sub-region, and 10% is generated in the WECC Northwest sub-region. EPA publishes average CO2 emissions rates for these sub-regions based on the various energy sources used to generate electricity within them (i.e., natural gas, hydropower, etc.) Table 7-8 shows the CO2 emissions rate for the three regions that produce the electricity used in California, and the average weighted rate for electricity used within the state. It is assumed that the mix of energy sources used by the state overall is representative of the energy source used to pump groundwater in Merced County.

Table 7-8: El Nido Area Recharge Project Additional Water Deliveries

WECC region	Emissions rate (MT/MWh)	Percent of California electricity use
California	0.299	70%
Southwest	0.540	20%
Northwest	0.372	10%
Weighted average emissions rate for electricity used in California	**0.354**	

Source: U.S. EPA eGRID data:
http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2012V1_0_year09_GHGOutputrates.pdf

Given the calculated weighted average CO2 emissions rate of 0.354 MT of CO2 emitted per MWh, 0.18 MT of CO2 are produced for every AF of groundwater pumped for agricultural use (509 kWh/AF multiplied by 0.354 MT/MWh). By eliminating use of approximately 3,681 AFY of imported water (at full implementation), the project will avoid emissions of more than 631 MT of CO2 per year. Over the 25-year expected lifetime of benefits, this project will avoid emissions of approximately 15,773 MT of CO2.

Other Physical Benefits

No other quantifiable benefits are being claimed as a result of project implementation.

Facilities Required to Achieve Benefits

In order to achieve the benefits summarized above, all project components must be implemented, including:

- Automated gate at the diversion dam
- Regrading of the recharge basin
- Agreement from farmers to take flows whenever available during winter months

Uncertainty of Benefits

Hydrology uncertainty is built into the main project benefit, which is the water supply aspect of the project. However the analysis was spread over more than 20 years reflecting periods of wet and dry to accommodate for such uncertainty.

Project Adverse Effects

The project will have temporary, construction-related impacts. No long-term adverse effects are expected from this project, and any adverse project effects will be fully mitigated.

Annual Project Physical Benefits

The following tables summarize the expected annual benefits from this project.

Table 7-9: El Nido Area Recharge Project Additional Water Deliveries

Project Name: El Nido Area Recharge Project Type of Benefit Claimed: Water Deliveries Measure of Benefit Claimed (Name of Units): Acre-Feet of Additional Recharge Additional Information About this Measure:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012-2015	0	0	0
2015-2039	0	4,489	4,489
Comments:			

Table 7-10: El Nido Area Recharge Project Avoided Groundwater Pumping

Project Name: El Nido Area Recharge Project Type of Benefit Claimed: Water Supply Measure of Benefit Claimed (Name of Units): Acre-Feet of Additional Recharge Additional Information About this Measure: Agricultural Use			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012-2015	0	0	0
2015-2039	0	3,501	3501
Comments:			

Table 7-11: El Nido CO_2 Emissions

Project Name: El Nido Area Recharge Project Type of Benefit Claimed: Avoided CO_2 Emissions Measure of Benefit Claimed (Name of Units): Metric Tons Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012-2014	0	0	0
2015-2039	0	631	631
Comments:			

Merced River Education and Enhancement Program

The Merced River Education and Enhancement Project has three components which collectively provide recreational access and public education to DACs in the area with the additional benefit of climate change response. The three components are as follows:

1) *Lower Merced River Stewardship:* This component has six major tasks associated with implementation of restoration activities, education efforts, and community building. These tasks include a riparian corridor restoration, school education, community outreach programs, agricultural workshops, creation of a streamlined permitting workgroup and a life jacket loan and training program.

2) *Merced Region Climate Change Program:* This component includes three interrelated efforts to assess and respond to climate change impacts in the region. The first task includes real-time streamflow measurements in the upper Merced watershed. The second task includes real-time water cycle measurements and an improved snowpack sensor, which together can aid in predicting water supplies. The final tasks would provide climate change education for interested individuals and organizations, explicitly educating on the impacts of climate change in the upper basin on water supply in the MID service area.

3) *Lower Merced River Recreational Boating Public Access:* This component will improve recreational access to DACs by constructing an access point for safe launching to the River.

The Merced River Education and Enhancemen Program includes includes a signficant public education component combined with research efforts and enhanced recreational opportunities

Existing Data and Studies

The Project is supported by a series of studies documenting the potential project benefits, including:

- Merced River Corridor Restoration Plan (February 2002) – included as Appendix 7-15
- The Merced River Alliance Project Final Report, Volume I: Education and Outreach (September 2008) – included as Appendix 7-16
- The Merced River Alliance Project Final Report, Volume II: Biological Monitoring and Assessment (September 2008) – included as Appendix 7-17
- Merced Restoration Mapping – included as Appendix 7-18
- News Articles Related to Merced River Fatalities and Rescues – included as Appendix 7-19

Summary of Benefits

The projected project benefits include:

- **Environmental Resources**: The Lower Merced River Stewardship Project has a heavy emphasis on environmental restoration activities
- **Recreation**: The Lower Merced River Stewardship Project and Lower Merced River Boat Public Access Improvements will both increase recreational opportunities for the region
- **Other:** The Lower Merced River Stewardship Project and Lower Merced River Boat Public Improved safety for community members engaging in river recreation.

These benefits are summarized in the following table.

Table 7-12: Merced River Education and Enhancement Benefits Summary

Category	Benefit Summary
Water Supply	No quantified physical benefits
Water Quality	No quantified physical benefits
Flood Damage Reduction	No quantified physical benefits
Environmental Resources	Removal of invasive species (e.g. water hyacinth, arundo and star thistle) at 2 locations along the Merced River Habitat restoration at 2 demonstration sites covering a total of 5 acres Retirement of 2 acres of agriculture to enhance wildlife habitat
Recreation/Public Access	137 new recreational visitor days
Energy	No quantified physical benefits
Other Physical Benefits	1 life saved every 10 years due to river recreation safety improvements Reduction of 2 emergency responses per year to rescue people in the river

Background / Recent and Historical Conditions

The Merced River watershed has been impacted by a range of human interventions, including agriculture, mining, forestry and introduction of invasive species. A number of studies have characterized these issues. The Lower Merced River Stewardship component of the project seeks to further the understanding of Merced River conditions and to engage watershed residents in understanding streamflow dynamics and the impact of human actions on the health of the river.

The Merced River Corridor Restoration Plan contained several near-term recommendations for restoring the Merced River (see Appendix 7-15). Of these recommendations, a key near-term recommendation was to control non-native species throughout the river corridor, which has been integrated into the proposed project. The Merced River Alliance Project Report summarized two efforts – one involving extensive public outreach and the other biological monitoring (see Appendices 7-17 and 7-18). At the heart of the public outreach effort was the implementation of Adopt-a-Watershed in two area schools. The biological monitoring involved 95 sites for which biological data were collected, including the identification of non-native/invasive species.

There is a continued need to understand the streamflow dynamics of the Merced River to better predict water cycle patterns and to better characterize the water supply dynamics of this important agricultural area. Research to better understand the region's vulnerability to climate change is the focus of the Merced Region Climate Change component of the project.

Additionally, there is a need to enhance safe access to the Merced River for residents that rely on the Merced River for recreation. As indicated by the News Articles Relate to Merced River Fatalities and Rescues (see Appendix 7-19), there is a high demand for no-cost access to the Merced River. Additionally, a 2008 report conducted the California Department of Boating and Waterways found that there are almost twice as many non-motorized boats as motorized boats in California. Despite this fact, the report highlights hat motorized boating captures the lion's share of dollars spend on access improvements. This project is a small step in rectifying the problem of limited non-motorized boating access. The boat access that will be constructed as part of this project combined with the life jacket loan program of the Lower Merced River Stewardship component increases the safety of recreation.

Without Project Conditions

This project would facilitate public education and outreach, river stewardship, and data collection and analysis for the Merced River watershed. If watershed residents are not engaged and aware of the impacts of their actions on the River, the damage to the Merced River will continue. A better understanding of the flow dynamics of the river may help local agencies take action against climate change and better manage water supplies in the future. Without this data effort, the status quo, in which communities are unprepared for droughts and groundwater overdrafts routinely occur, will persist. Finally, improved river access through the boat launch project provides an important recreational opportunity to the DAC and minimizes vegetation damage and trash accumulation that currently result from unauthorized access to the river. Without the associated life jacket element of this project, there will continue to be river rescues and potential injuries from unsafe practices in the river.

Relationship to Other Proposed Projects

As discussed in Attachment 3, the projects included in this proposal are all intrinsically linked through the objectives of the Merced Integrated Regional Water Management Program. However, no other projects in this proposal must be implemented to achieve the benefits claimed in this attachment.

Description of Benefits and Methods to Estimate Benefits

The following sections summarize project benefits and methods used to estimate benefits in the following areas:

- Water Supply
- Water Quality
- Flood Damage Reduction
- Environmental Resources
- Recreation/Public Access
- Energy
- Other Physical Benefits

Water Supply Benefits

No quantifiable water supply benefits are claimed as a result of project implementation.

Water Quality Benefits

No quantifiable water quality benefits are claimed as a result of project implementation.

Flood Damage Reduction Benefits

No quantifiable water quality benefits are claimed as a result of project implementation.

Environmental Benefits

Mapping that was completed along the Merced River in 2006 identified numerous sites with invasive species (see Appendix 7-18). The Lower Merced River Stewardship component of the Merced River Education and Enhancement is requesting funding to improve and update the mapping and perform removal of invasive species (e.g. water hyacinth, arundo and star thistle) at 2 locations along the Merced River.

The Lower Merced River Stewardship component also includes habitat restoration activities at 2 demonstration sites that cover a total of 5 acres, including the retirement of 2 acres of agriculture to enhance wildlife habitat.

Recreation/Public Access Benefits

Whitewater boating visitation to the Merced River is expected to increase as a result of the improved access constructed through the Lower Merced River Recreational Boating Public Access component of the project. The population of the communities that border the Merced River is 13,683. It is estimate that 1% of these residents, or 137 , will undertake one new day of boating or rafting per year as a result of this project.

Energy-Related Benefits

No quantifiable energy-related benefits are being claimed as a result of project implementation.

Other Physical Benefits

As documented in several Merced Sun Star articles including *Girl who drowned in Merced River identified* and *Caution on Merced River emphasized* (see Appendix 7-19), proper safety equipment, e.g. life jackets, should be used by those who use the County's waterways. The most recent recorded fatality on the Merced River was the accidental drowning of a 6-year who was wading in relatively shallow water while visiting McConnell State Recreation Area; park rangers and Sheriff's deputies believe that her death would have been adverted if she had been wearing a life jacket. Park rangers at McConnel State Recreation Area recall a similar incident with the accidental drowning of a teenager in the late 1990s. The life jacket loan program that will be implemented through this project is estimated to save 1 life every 10 years.

The combination of the life jacket loan program, safety programs and improved river access offered by the Lower Merced River Stewardship and Lower Merced River Recreational Boating Public Access components is anticipated to reduce the need for emergency rescues on the river. A search of local news articles for the Merced River turned up 4 separate emergency rescues in 2011 (see Appendix 7-19), and Sheriff's Department records identify 5 emergency calls in 2012. This project is estimated to reduce the number of emergency calls by 2 per year.

Facilities Required to Achieve Benefits

In order to achieve the benefits summarized above, all project components must be implemented, including:

- Securing materials, including kayaks and life jackets for stewardship efforts
- Construction of the boat access and associated ammenities

Uncertainty of Benefits

The benefits claimed will vary depending on public participation/adoption of programs.

Project Adverse Effects

The project will have temporary, construction-related impacts. No long-term adverse effects are expected from this project, and any adverse project effects will be fully mitigated.

Annual Project Physical Benefits

The following tables summarize the expected annual benefits from this project.

Table 7-13: Merced River Education and Enhancement Program Recreation/Public Access

Project Name: Merced River Education and Enhancement Program Type of Benefit Claimed: Recreation/Public Access Measure of Benefit Claimed (Name of Units): Increased Boating User-Days Additional Information About this Measure:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2013-2014	0	0	0
2015-2029	0	137	137
Comments:			

Table 7-14: Merced River Education and Enhancement Program Saved lives

Project Name: Merced River Education and Enhancement Program Type of Benefit Claimed: Saved Lives Measure of Benefit Claimed (Name of Units):Avoided Water Related Death Additional Information About this Measure:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0
2021	0	0	0
2022	0	1	1
2023	0	0	0
2024	0	0	0
2025	0	0	0
2026	0	0	0
2027	0	0	0
2028	0	0	0
2029	0	0	0
Comments:			

Table 7-15: Merced River Education and Enhancement Program Emergencies Avoided

Project Name: Merced River Education and Enhancement Program Type of Benefit Claimed: Emergencies Avoided Measure of Benefit Claimed (Name of Units):Avoided Emergency Response Additional Information About this Measure:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2013-2014	0	0	0
2015-2029	4	2	2
Comments:			

Merced Integrated Regional Water Management Implementation Grant Proposal

Appendices 7-1 to 7-19 provided on CD

App. #	Document Title	File Name
App. 7-1	Feasibility Study and Addendum 1, Black Rascal Creek Flood Control	Att7_IG2_TechJust_2of20
App. 7-2	Merced County Streams California, General Design Memorandum Phase 1 Plan Formulation	Att7_IG2_TechJust_3of20
App. 7-3	MIRWMP Flood Management Summary	Att7_IG2_TechJust_4of20
App. 7-4	Hemming & Morse Inc, Expert Report of Daniel W. Ray, Abarca, el al. v. Merced Irrigation District, et. al. United States District Court Case No. 1:07-CV-0388 OWW DLB.	Att7_IG2_TechJust_5of20
App. 7-5	Merced March & April 2006 California County Agricultural Commissioner Disaster Report	Att7_IG2_TechJust_6of20
App. 7-6	Preliminary Engineering Report for the Water System Rehabilitation & Conservation Project	Att7_IG2_TechJust_7of20
App. 7-7	Planada Community Services Minutes January 4, 2011	Att7_IG2_TechJust_8of20
App. 7-8	Planada 2011 and 2012 Water Use Data	Att7_IG2_TechJust_9of20
App. 7-9	Merced Irrigation District Water Right Summary for El Nido Irrigation District	Att7_IG2_TechJust_10of20
App. 7-10	Well Level Compilation	Att7_IG2_TechJust_11of20
App. 7-11	El Nido Additional Recharge Calculation	Att7_IG2_TechJust_12of20
App. 7-12	Merced County Division of Environmental Health Private Domestic Well Data	Att7_IG2_TechJust_13of20
App. 7-13	Merced County Division of Environmental Health Private Domestic Well Data	Att7_IG2_TechJust_14of20
App. 7-14	El Nido Area Pump Test Data	Att7_IG2_TechJust_15of20
App. 7-15	Merced River Corridor Restoration Plan	Att7_IG2_TechJust_16of20
App. 7-16	The Merced River Alliance Project Final Report; Volume I: Education and Outreach	Att7_IG2_TechJust_17of20
App. 7-17	The Merced River Alliance Project Final Report; Volume II: Biological Monitoring and Assessment	Att7_IG2_TechJust_18of20
App. 7-18	Merced Restoration Mapping	Att7_IG2_TechJust_19of20
App. 7-19	News Articles Related to Merced River Fatalities and Rescues	Att7_IG2_TechJust_20of20